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(54) **TIGHTENING DEVICE**

**SPANNVORRICHTUNG**

**DISPOSITIF DE SERRAGE**

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**US-A- 4 493 597**

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## Description

### TECHNICAL FIELD

[0001] This invention relates to a tightening device for tightening up a tightening member including a bolt, nut, screw and the like.

[0002] More particularly, this invention relates to a tightening device having a function of imparting an energizing force in the tightening direction to the tightening member to be screwed to a tightening object to be retained for a long time continuously from the beginning of tightening.

### BACKGROUND ART

[0003] In general, when tightening a number of tightening members onto one tightening object, tightening force to be imparted to the tightening members must be equalized in order for assuring the entire tightening strength. However, if the same worker uses the same tool for tightening the tightening members, it is difficult to equalize the tightening force to be imparted to the tightening members.

[0004] Furthermore, the tightening member secured to the tightening object is sometimes slackened due to some subsequent events (deterioration, fatigue, desiccation, etc.) happened on the tightening object.

[0005] Under the circumstances, a need has been felt for development in a tightening device capable of uniformly tightening lots of tightening members and preventing the tightening object tightened with tightening members from loosening over a longer span of time.

[0006] There has been known in the prior art a tightening device satisfying the aforesaid requirements disclosed in PCT Patent Application Publication No. WO00/01/01509.

[0007] This conventional tightening device comprises an engaging part engaged with the tightening member, which is integrally disposed on one end portion of an energizing member for energizing the tightening member to be secured onto the tightening object in the tightening direction, and a switching member connected to the energizing member for switching over to its constraining or operating state of the energizing force imparted to the tightening member. The switching member is fitted to the outer periphery of the energizing member formed of a spiral spring, so that the energizing force is prevented from being imparted to the tightening member by constraining elastic expansion of the energizing member in its fitted state (constraining function), and the energizing force is imparted to the tightening member by permitting elastic expansion of the energizing member in the state of releasing (breaking or the like) the fitted state (operating state).

[0008] When using the conventional tightening device, the switching member is engaged with the energizing member, which retains the energizing force by

compression, and then, upon engaging the engaging part of the energizing member with the tightening member, the engagement of the switching member with the energizing member is released to impart the energizing force to the tightening member.

[0009] The conventional tightening device has an advantage in that it is simple in structure and easy to handle.

[0010] However, the conventional tightening device has a disadvantageous possibility of releasing the engagement of the switching member with the energizing member where the energizing force is strong, because the switching member is merely engaged with the outer periphery of the energizing member, thus unsteadily hindering the expansion of the energizing member. Besides, the switching member in its released state stays behind around the outer periphery of the energizing member, thus leading to inhibition of the energizing function of the energizing member and causing a corrosion around the energizing member.

### DISCLOSURE OF THE INVENTION

[0011] The present invention was made in view of the foregoing problems of the conventional tightening device and seeks to provide a tightening device having a switching member capable of stably constraining an energizing force of the energizing member, which is imparted to a tightening member and being separated from the periphery of the energizing member when activating the energizing member to impart the energizing force to the tightening member.

[0012] As one means for solving the problems described above, according to the present invention as mentioned in claim 1, there is provided a tightening device comprising an energizing member for energizing a tightening member to be secured to a tightening object in a tightening direction, which energizing member integrally has at its one end portion an engaging part to be engaged with the tightening member, and a switching member connected to the tightening member for switching over to the constraining or operating state of the energizing force imparted to the tightening member by the energizing member, which tightening device is characterized in that the switching member holds tight the engaging part formed on the one end portion of the energizing member and the other end portion thereof to constrain the energizing force and is separated from the engaging part and the other end portion of the energizing member to activate the energizing force.

[0013] According to this solution means, the switching member is held tight from both sides to stably constrain the energizing force. Furthermore, the switching member is separated from the energizing member when activating the energizing member to impart the energizing force to the tightening member, so that the switching member can be separated from the periphery of the energizing member.

[0014] As another means for solving the problems described above, according to the present invention as mentioned in claim 2, the switching member in the tightening device set forth in claim 1 is separated slidably from the engaging part and the other end portion of the energizing member while engaging the engaging part of the energizing member with the tightening member.

[0015] According to this solution means, the switching member can be separated automatically from the energizing member as the engaging part of the energizing member with the tightening member.

[0016] As still another means for solving the problems described above, according to the present invention as mentioned in claim 3, the energizing member in the tightening device set forth in claim 2, the energizing member is formed of a spiral spring and contained within a casing, the engaging part of the one end portion of the energizing member is placed at the center of the spiral spring, and the other end portion of the energizing member is placed at the outer periphery of the spiral spring.

[0017] According to this solution means, the engaging part of the energizing member of the spiral spring contained within the casing serves as a base point of the energizing force.

[0018] As the other means for solving the problems described above, according to the present invention as mentioned in claim 4, the casing of the tightening device set forth in claim 3 has engaging dents for permitting the switching member to be engaged with the casing in the circumferential direction and the switching member to slidably move in the axial direction, and the engaging member has engaging cuts correspondingly to the engaging dents formed in the casing.

[0019] According to this solution means, the casing and the switching member can be engaged steadily with each other by means of the engaging dents and cuts.

[0020] As the other means for solving the problems described above, according to the present invention as mentioned in claim 5, the engaging dents and cuts formed in the casing and the switching member in the tightening device set forth in claim 3 respectively assume a polygonal shape so as to vary the engagement angle at which the casing and switching member are engaged, wherein the engaging cuts of the switching member are formed in the peripheral portion of a flange having a larger diameter than a support part of the switching member.

[0021] According to this solution means, the engagement angle between the casing and the switching member is variable.

[0022] As the other means for solving the problems described above, according to the present invention as mentioned in claim 6, the support part of the switching member in the tightening device set forth in claim 5 is rotatable within the casing while holding the engaging part and the other end portion of the energizing member in the state of separating the flange with engaging cuts from the engaging dents formed in the casing.

[0023] According to this solution means, the energizing force of the energizing member can be adjusted by winding up or unloosing the energizing member with rotation of the switching member in the released state from the engaging dents of the casing.

[0024] As the other means for solving the problems described above, according to the present invention as mentioned in claim 7, the tightening device set forth in any of claim 3 to claim 6 may be provided with a fixing member attached directly or indirectly to one side of the casing opposite to a tightening object to be retained in an anti-rotatable manner.

[0025] According to this solution means, the casing can be immovably fixed to the tightening object with the fixing member.

#### BRIEF DESCRIPTION OF THE DRAWINGS

##### [0026]

FIG. 1 is a perspective exploded view showing one preferred embodiment of a tightening device according to the present invention.

FIG. 2 is a diagram showing the initial state of assembling the device of FIG. 1 in use.

FIG. 3 is a diagram showing the state in course of assembling the device of FIG. 1 in use.

FIG. 4 is a diagram showing the state of completion of assembling the device of FIG. 1 in use.

FIGS. 5 are expanded sectional views of FIG. 2 through FIG. 4, wherein FIG. 5(A) corresponds to FIG. 2, FIG. 5(B) corresponds to FIG. 3, and FIG. 5(C) corresponds to FIG. 4.

FIGS. 6 are cross sectional views of FIGS. 5, wherein FIG. 6(A) corresponds to FIG. 5(A), FIG. 6(B) corresponds to FIG. 5(B), and FIG. 6(C) corresponds to FIG. 5(C).

FIG. 7 is an exploded view showing the principal portion of the second preferred embodiment of the tightening device according to the present invention.

FIG. 8 is an exploded view showing the third preferred embodiment of the tightening device in the state of being assembled in use according to the present invention.

FIG. 9 is an exploded view showing the fourth preferred embodiment of the tightening device according to the present invention.

#### 50 BEST MODE FOR CARRYING OUT THE INVENTION

[0027] FIG. 1 through FIG. 6 show the first preferred embodiment for achieving the tightening device according to the present invention.

55 [0028] Shown as the first embodiment is the device comprising a tightening member B such as a hexagonal nut to be fitted onto a bolt retained by a tightening object A formed of concrete or the like.

[0029] The tightening device of this first embodiment comprises a casing 1, an energizing member 2, and a switching member 3 as shown in FIG. 1.

[0030] In general, it is desirable to make the casing 1, energizing member 2 and switching member 3 of metal, but these may be made of synthetic resin or other single or composite material.

[0031] The casing 1 comprises an inverted cup-shaped main body 11, and a bottom member 12 which is made of a plate with hole and deformed so as to close up the lower opening of the main body 11. The main body 11 has a top plate 11a with a sliding hole 11c for allowing the switching member 3 to slide, a cylindrical side wall 11d provided with fixing pieces 11e to be caught on the fringe of the bottom member 12 by being bent inwardly at 90 degrees, and an engaging slit 11f for receiving the energizing member 2. The sliding hole is defined by an inner peripheral edge of engaging dents 11b. The bottom member 12 comprises a centrally located through hole 12a for allowing the tightening member B to pass therethrough, squarish U-shaped fixing slots 12b for receiving the fixing pieces 11e of the main body 11, and L-shaped fixing pieces 12c by which the tightening member B is indirectly connected to the tightening object A in an anti-rotatable manner.

[0032] The energizing member 2 comprises a spring body 21 composed of a spiral spring of belt-like steel sheet, an engaging part 22 formed by folding the inner end portion of the spiral spring body into a hexagonal shape so as to bring the tightening member B into engagement therewith, and a hook part 23 formed by curving the outer end portion of the spiral spring body 21 so as to be secured into the engaging slit 11f in the main body 11. The spring body 21 is wound sinistrorsely (counterclockwise).

[0033] The switching member 3 comprises a support part for retaining the energizing member 2, and a flange 32 having a larger diameter than the support part 31. The support part 31 has a hexagonal inner support 31a fitted into the engaging part 22 of the energizing member 2, and two outer supports 31b, which are each formed like a short pillar bent at 90 degrees so as to come into contact with the outer peripheral surface of the spring body 21 of the energizing member 2 in the compressed state. In the peripheral surface of the flange 32, there are formed engaging cuts 33 assuming a hexagonal shape on the whole so as to be engaged with the engaging dents 11b of the main body 11 of the casing 1 in an angular-adjustable manner.

[0034] The casing 1, energizing member 2 and switching member 3 are assembled by placing the energizing member 2 into the main body 11 of the casing 1, bringing the hook part 23 of the energizing member 2 into engagement with the engaging slit 11f formed in the main body 11 of the casing 1, and securing the bottom member 12 to the main body 11 of the casing 1. Before using, the energizing member 2 placed in the casing 1 is compressed. Then, the energizing member

2 is retained in its compressed state by the switching member 3, making preparations for bringing the sliding hole 11c in the main body 11 of the casing 1 into engagement with the flange defined by the engaging cuts 33 (cf. FIG. 5(A) and FIG. 6(A)).

[0035] In this state, the energizing force of the energizing member 2 is constrained and prevented from being imparted to the engaging part 22. This constrained state of the energizing member is stably maintained by the holding action of the inner support 31a and outer support 31b of the support part 31 of the switching member 3.

[0036] The energizing member 2 may be compressed before shipment of the finished device. With change of the engagement angle between the engaging dents formed around the sliding hole 11c in the main body 11 of casing 1 and engaging cuts 33 formed around the flange of the switching member 3, the degree of compression of the energizing member 2 can be changed to adjust the energizing force.

[0037] In this first embodiment, a mount seat 5 is attached onto the tightening object A through a spacing block 4 as shown in FIG. 2 and FIG. 5.

[0038] The spacing block 4 and mount seat 5 are fixed onto the tightening object A with the tightening member B by screwing. The mount seat 5 has a body plate 51 provided on its peripheral portion with engaging tags 52 circumferentially arranged at right angles so as to prevent the fixing member of the bottom member 12 attached to the casing 1 from rotating.

[0039] According to this structure in the first embodiment, the casing 1, energizing member 2 and switching member 3 assembled as noted above are united with the tightening member B by being placed on the top of the tightening member B and being slightly rotated, as shown in FIG. 2. Thus, the fitting of these components onto the tightening member does not require onerous process.

[0040] Upon fitting these components onto the tightening member, the tightening member B fitted into the engaging part 22 of the energizing member 2 through the hole 12a in the bottom member 12 of the casing 1 pushes up the switching member 2 by sliding as shown in FIG. 3 and FIG. 5(B). In the state of pushing up the switching member 2, the energizing force of the aforementioned energizing member 2 remains constrained.

[0041] Thereafter, the switching member 3 is pulled out from the energizing member 2 and the sliding hole 11c in the main body 11 of the casing 1, as shown in FIG. 4. At this time, the switching member 3 can easily be pulled off by operating the flange 32 of the switching member 3 with the fingers of a user.

[0042] As a result, the energizing member 2 is released from the switching member 3 to impart the energizing force of the energizing member 2 to the engaging part 22, thus bringing the device into the operating state as shown in FIG. 5(C) and FIG. 6(B). Therefore, the tightening member B is continuously constricted by the

energizing force of the energizing member 2.

[0043] In this state, the switching member 3 is disengaged from the casing 1 and energizing member 2. Thus, the possibility that the switching member 3 attached to the casing and energizing member constitutes a limiting factor of suppressing the function of energizing member 2 and causing a corrosion can be eliminated.

[0044] The sliding hole 11c in the main body 11 of the open casing 1 may be closed with a cover or the like if required.

[0045] FIG. 7 shows the second preferred embodiment for carrying out the present invention.

[0046] This second embodiment can prevent any foreign matter from entering inside through between the engaging dent 11b in the main body 11 of the casing 1 and the engaging cut 33 of the switching member 3 before use.

[0047] FIG. 8 shows the third preferred embodiment for carrying out the present invention.

[0048] In this third embodiment, the fixing pieces 12c extending from the bottom member 12 of the casing 1 in the first embodiment are each modified into a cuneate shape.

[0049] According to this third embodiment, the fixing pieces 12c of the bottom member 12 of the casing 1 can be mounted directly into the tightening object A so as to secure the device in an anti-rotatable manner. This embodiment eliminates the need for the spacing block 4 and mount seat 5, and therefore, is specifically effective for the tightening object A made of wood.

[0050] FIG. 9 shows the fourth preferred embodiment for carrying out the present invention.

[0051] In the fourth embodiment, the casing 1 found in the first to third embodiments is left out. The switching member 3 and engaging cuts 33 are omitted as well as the casing 1.

[0052] In place of the casing 1, an engaging pin 6 for securing the energizing member 2 directly onto the tightening object A in an anti-rotatable manner is attached to the outer end of the energizing member 2.

[0053] According to this fourth embodiment, the overall structure of the device can be made simple.

[0054] In the first to fourth embodiments, the energizing member 2 may be formed of a slidably expanding spring.

#### INDUSTRIAL APPLICABILITY

[0055] The present invention may have applicability to a tightening object of metal, synthetic resin, concrete, wood or other pertinent material

[0056] Furthermore, as the tightening member, there may be used not only bolts, nuts and screws, but also all kinds of tightening elements capable of being tightened up to be secured to the tightening object.

#### Claims

1. A tightening device comprising an energizing member (2) for energizing a tightening member (B) to be secured to a tightening object in a tightening direction, said energizing member (2) being provided integrally at its one end portion with an engaging part (22) to be engaged with the tightening member (B), and a switching member (3) connected to the tightening member (2) for switching over to one of the constraining and operating states of the energizing force imparted to the tightening member (B) by the energizing member, **characterized by** the switching member (3) comprising a support part (31) having an inner support (31a) engaged with said engaging part (22) of said energizing member (2) and outer supports (31b) in contact with the outer peripheral surface of said energizing member (2) so as to constrain the energizing force, and a casing (1) containing said energizing member (2) with one end portion caught by said casing (1), said casing (1) having a sliding hole (11a) for allowing said switching member (3) to be pushed up by said tightening member (B) to separate said switching member (3) from said engaging part (22) of said energizing member (2).
2. The tightening device set forth in claim 1, wherein said energizing member (2) is formed of a spiral spring (21) and contained within a casing (11), the engaging part of the one end portion of said energizing member (2) is placed at the center of said spiral spring (21), and the other end portion of said energizing member (2) is placed at the outer periphery of said spiral spring (21).
3. The tightening device set forth in claim 2, wherein said casing (11) has engaging dents (11b) for permitting said switching member (3) to be engaged with said casing (11) in the circumferential direction and said switching member (3) to slidably move in the axial direction, and said engaging member has engaging cuts correspondingly to the engaging dents (11b) formed in said casing (11).
4. The tightening device set forth in claim 3, wherein said engaging dents (11b) and cuts formed in said casing (11) and said switching member (3) respectively assume a polygonal shape so as to vary an engagement angle at which said casing (11) and switching member (3) are engaged, said engaging cuts of said switching (3) member being formed in the peripheral portion of a flange having a larger diameter than a support part of said switching member (3).
5. The tightening device set forth in claim 4, wherein said support part of said switching member (3) is

rotatable within said casing (4) while holding said engaging part and the other end portion of said energizing member (2) in the state of separating said flange with engaging cuts from said engaging dents formed in said casing (11).

6. The tightening device set forth in any of claims 2-5, further comprising a fixing member attached directly or indirectly to one side of said casing (11) opposite to a tightening object to be retained in an anti-rotatable manner.

#### Patentansprüche

1. Eine Spannvorrichtung, welche ein antreibendes Element (2) umfasst, um ein Spannelement (B) anzutreiben, welches in Spannrichtung an einem Spannobjekt zu befestigen ist, wobei das antreibende Element (2) an seinem einen Ende einstückig mit einem Eingriffselement (22), an dem das Spannobjekt (B) eingreifen soll, und mit einem mit dem antreibenden Element (2) verbundenen Schaltelement (3) versehen ist, um zwischen einem arretierten und einem arbeitsfähigen Zustand der Antriebskraft, die von dem antreibenden Element (2) an das Spannelement (B) weitergegeben wird, umzuschalten, **dadurch gekennzeichnet, dass** das Schaltelement (3) einen Halterungsabschnitt (31) umfasst, der eine innere Haltung (31a), die von der Eingriffsvorrichtung (22) des antreibenden Elements (2) aufgenommen wird, und äußere Halterungen (31b), die sich im Kontakt mit der äußeren Umfangsfläche des antreibenden Elements (2) befinden, um so die antreibende Kraft einzuschränken, und ein Gehäuse (1) hat, welches das antreibende Element (2) enthält, das mit einem Endabschnitt in dem Gehäuse (1) eingehakt ist, und das Gehäuse (1) ein Gleitloch (11c) hat, um es dem Schaltelement (3) zu erlauben, von dem Spannelement (B) nach oben gedrückt zu werden, um das Schaltelement (3) von dem Eingriffselement (22) des antreibenden Elements (2) zu trennen.
2. Die Spannvorrichtung nach Anspruch 1, worin das antreibende Element (2) aus einer Spiralfeder (21) gebildet und in einem Gehäuse (11) enthalten ist, wobei das Eingriffselement (22) des einen Endabschnitts des antreibenden Elements (2) im Mittelpunkt der Spiralfeder (21) platziert ist und der andere Endabschnitt des antreibenden Elements (2) am äußeren Umfang der Spiralfeder (21) platziert ist.
3. Die Spannvorrichtung nach Anspruch 2, worin das Gehäuse (11) Eingriffskerben (11b) hat, um zu ermöglichen, dass das Schaltelement (3) in Umfangsrichtung mit dem Gehäuse (11) im Eingriff steht und dass sich das Schaltelement (3) gleitend in axialer

Richtung bewegt, und worin das aufnehmende Teil Eingriffseinschnitte hat, die korrespondierend zu den Eingriffskerben (11b) in dem Gehäuse (11) geformt sind.

4. Die Spannvorrichtung gemäß Anspruch 3, worin die Eingriffskerben (11b) und -einschnitte, die jeweils in dem Gehäuse (11) und dem Schaltelement (3) geformt sind, eine vieleckige Form annehmen, um so den Aufnahmewinkel zu variieren, in dem das Gehäuse (11) und das Schaltelement (3) verbunden sind, wobei die Eingriffselemente des Schaltelements (3) im Umfangsabschnitt eines Flansches geformt sind, der einen größeren Durchmesser als der Halterungsteil des Schaltelements hat.
5. Eine Spannvorrichtung nach Anspruch 4, worin der Halterungsteil des Schaltelements (3) in dem Gehäuse (11) drehbar ist, während das Eingriffselement (22) und der andere Endabschnitt des antreibenden Elements (2) im Zustand der Trennung des Flansches mit Eingriffseinschnitten von den Eingriffskerben, die in dem Gehäuse (11) geformt sind, gehalten werden.
6. Die Spannvorrichtung nach einem der Ansprüche 2 - 5, ferner umfassend ein Befestigungsteil, das direkt oder indirekt an einer Seite des Gehäuses (11) gegenüber von einem Spannobjekt befestigt ist, um in nicht drehbarer Weise festgehalten zu werden.

#### Revendications

1. Dispositif de serrage comprenant un organe d'activation (2) pour l'activation d'un organe de serrage (13) à fixer à un objet de serrage dans une direction de serrage, ledit organe d'activation (2) étant prévu de manière intégrale à sa une portion d'extrémité avec une pièce d'engagement (22) à engager avec l'organe de serrage (13), et un organe de commutation (3) connecté à l'organe de serrage (2) en vue de la commutation sur l'un des états de contrainte et d'exploitation de la force d'activation impartie à l'organe de serrage (13) par l'organe d'activation, **caractérisé par** l'organe de commutation (3), comprenant une pièce de support (31) ayant un support interne (31a) engagé avec ladite pièce d'engagement (22) dudit organe d'activation (2), et des supports externes (31b) en contact avec la surface périphérique externe dudit organe d'activation (2) de manière à contraindre la force d'activation, et une caisse (1) contenant ledit organe d'activation (2) avec une portion d'extrémité prise par ladite caisse (1), ladite caisse (1) ayant un trou de glissement (11c), permettant audit organe de commutation (3) d'être poussé vers le haut par ledit organe de serrage (13) pour séparer ledit organe de commutation

(3) de ladite pièce d'engagement (22) dudit organe d'activation (2).

2. Dispositif de serrage selon la revendication 1, dans lequel ledit organe d'activation (2) est formé d'un ressort en spirale (21) et est contenu au sein d'une caisse (11), dans lequel la pièce d'engagement de la une portion d'extrémité dudit organe d'activation (2) est placée au centre dudit ressort en spirale (21) et dans lequel l'autre portion d'extrémité dudit organe d'activation (2) est placée à la périphérie externe dudit ressort en spirale (21). 5 10
3. Dispositif de serrage selon la revendication 2, dans lequel ladite caisse (11) a des dents d'engagement permettant l'engagement dudit organe de commutation (3) avec ladite caisse (11) dans la direction circonférentielle et le mouvement par glissement dudit organe de commutation (3) dans la direction axiale, et dans lequel ledit organe d'engagement a des entailles d'engagement correspondant aux dents d'engagement (11b) formées dans ladite caisse (11). 15 20
4. Dispositif de serrage selon la revendication 3, dans lequel lesdites dents d'engagement (11b) et lesdites entailles formées dans ladite caisse (11) et ledit organe de commutation (3), respectivement, assument une forme polygonale de manière à varier un angle d'engagement auquel ladite caisse (11) et ledit organe de commutation (3) sont engagés, lesdites entailles d'engagement dudit organe de commutation (3) étant formées dans la portion périphérique d'une collerette ayant un diamètre plus grand qu'une pièce de support dudit organe de commutation (3). 25 30 35
5. Dispositif de serrage selon la revendication 4, dans lequel ladite pièce de support dudit organe de commutation (3) peut subir une rotation au sein de ladite caisse (11), tout en maintenant ladite pièce d'engagement, et l'autre portion d'extrémité dudit organe d'activation (2) dans l'état de séparation de ladite collerette avec les entailles d'engagement desdites dents d'engagement formées dans ladite caisse (11). 40 45
6. Dispositif de serrage selon l'une quelconque des revendications 2-5, comprenant en outre un organe de fixation attaché directement ou indirectement à un côté de ladite caisse (11), opposée à un objet de serrage à retenir d'une manière non capable de rotation. 50

55

Fig. 1

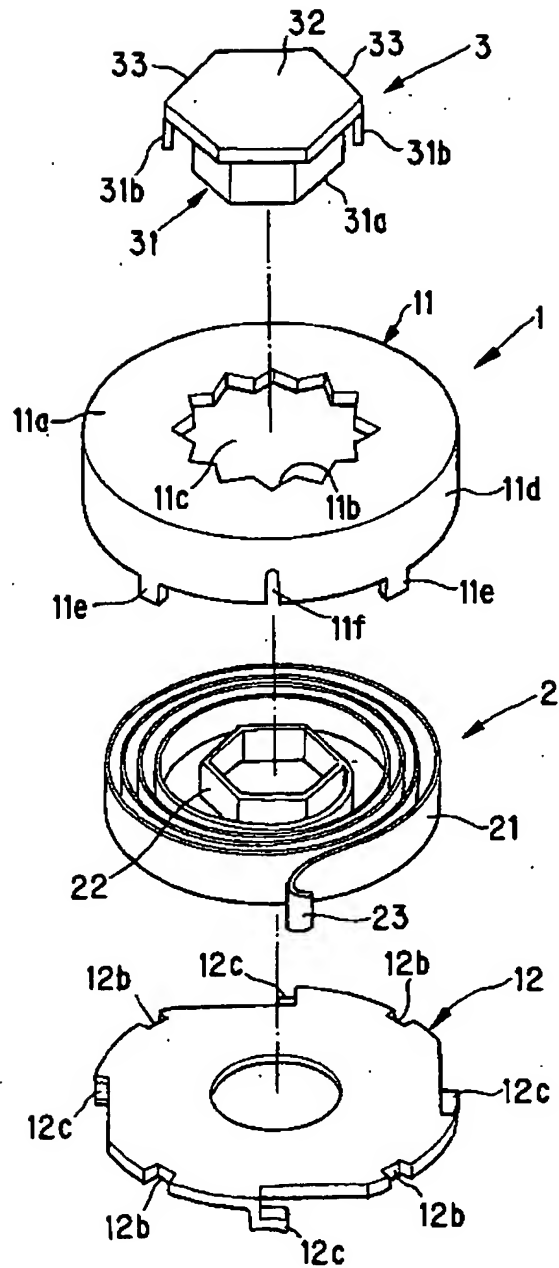
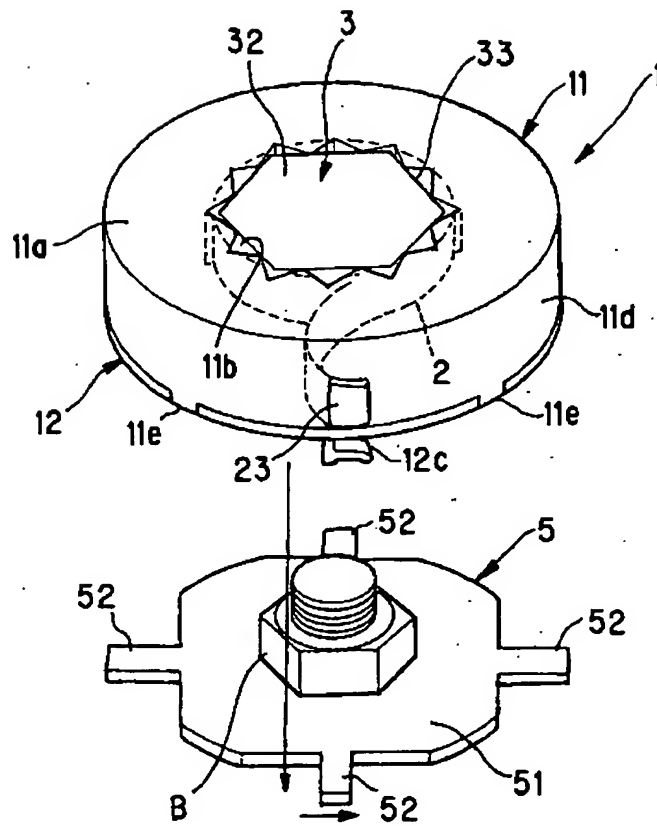




Fig. 2



F i g . 3

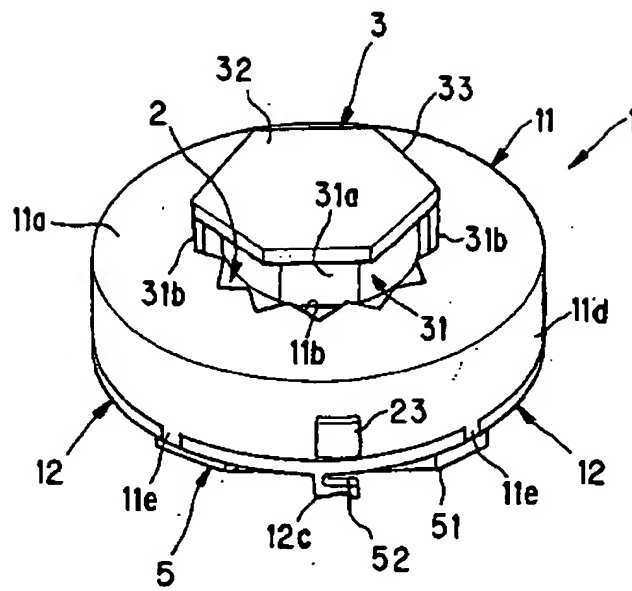


Fig. 4

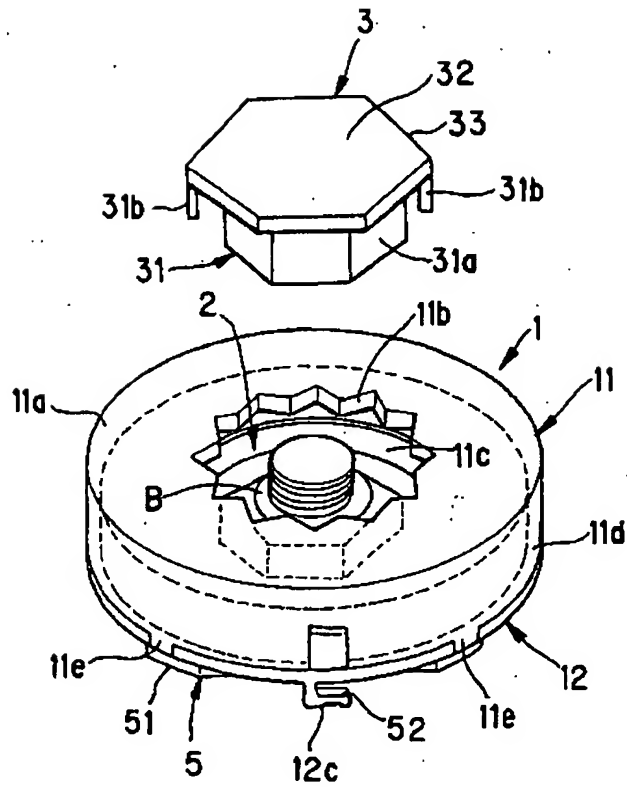


Fig. 5  
(A)

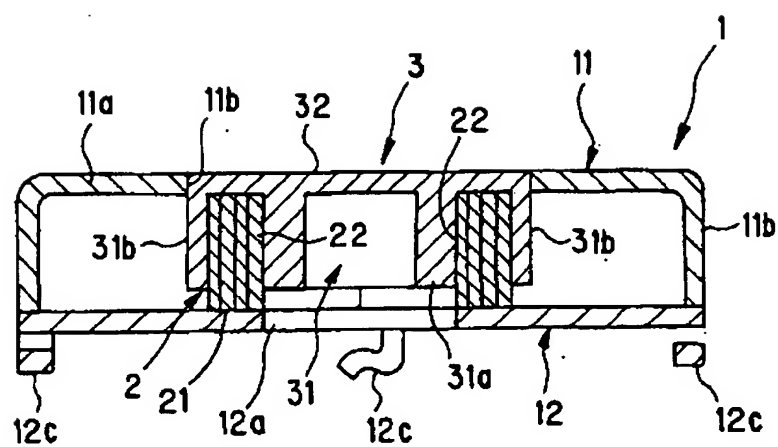


Fig. 5  
(B)

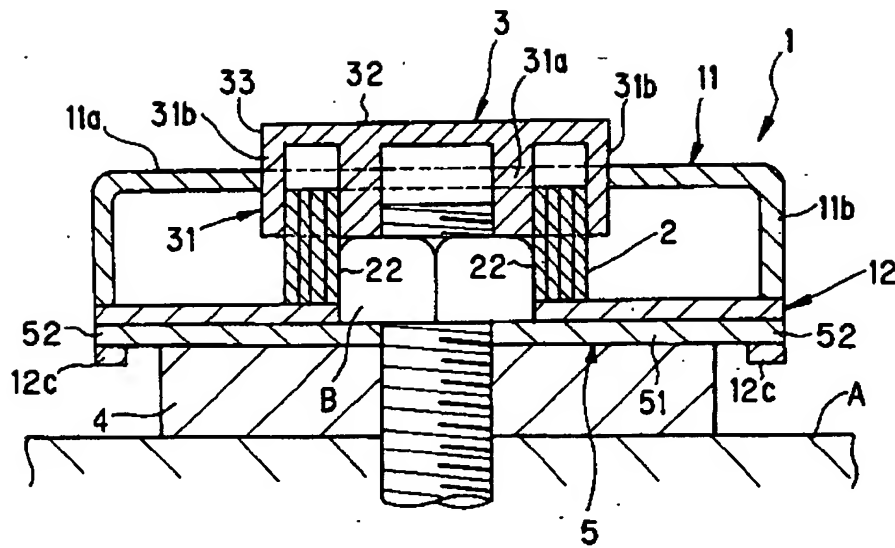
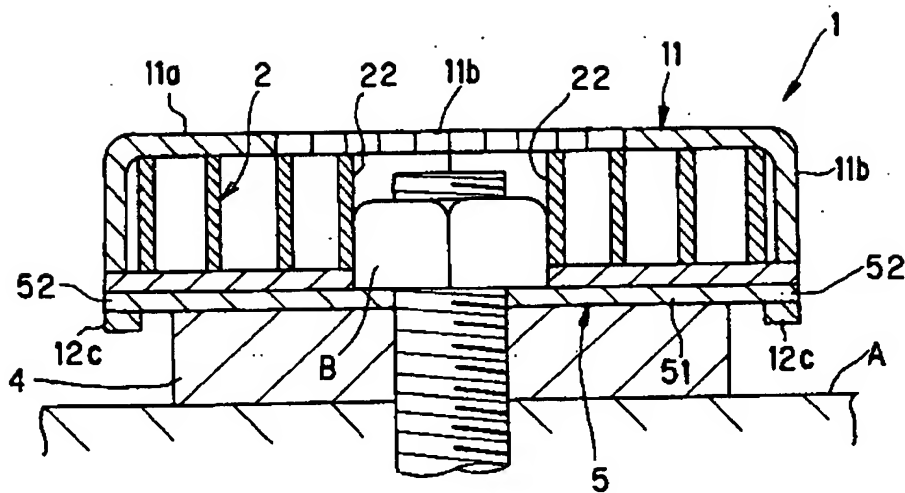
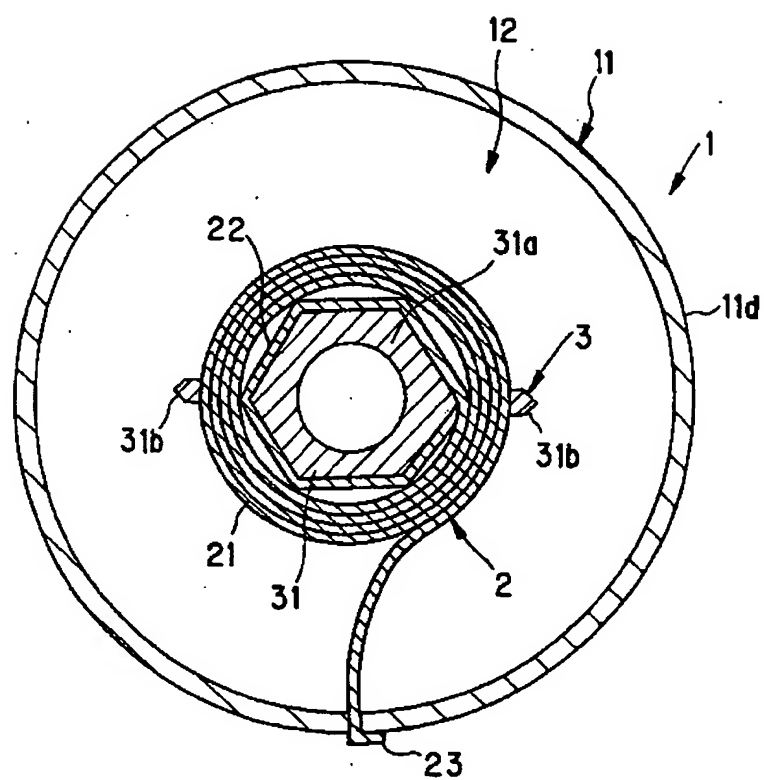


Fig. 5  
(C)



F i g. 6

(A)



F i g . 6

( B )

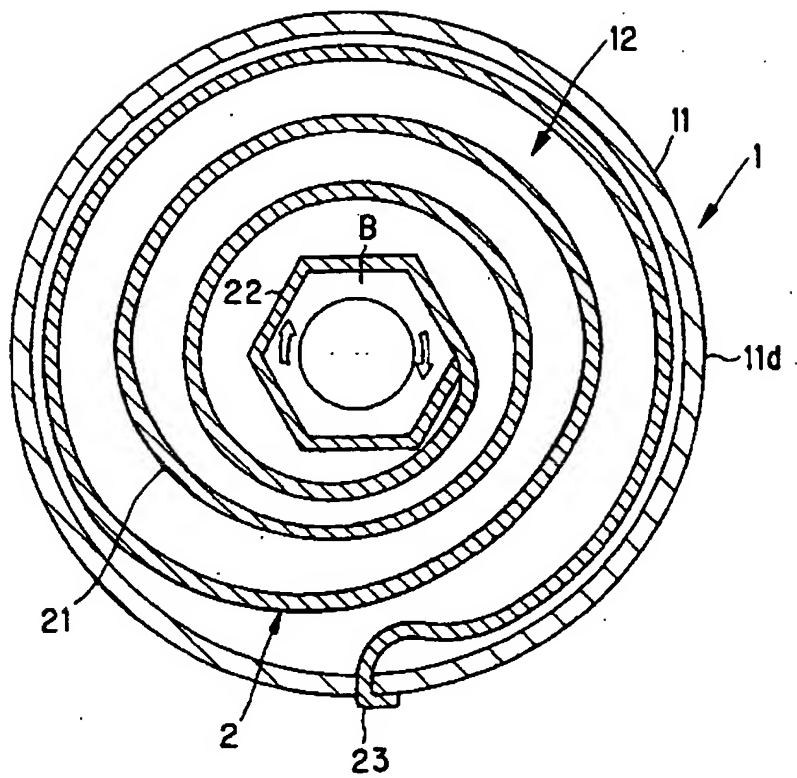
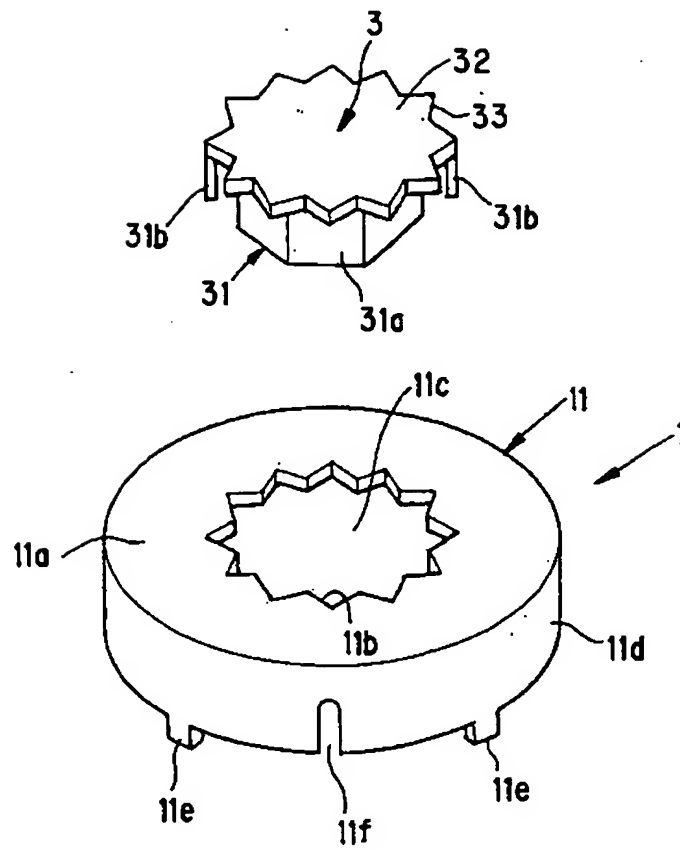
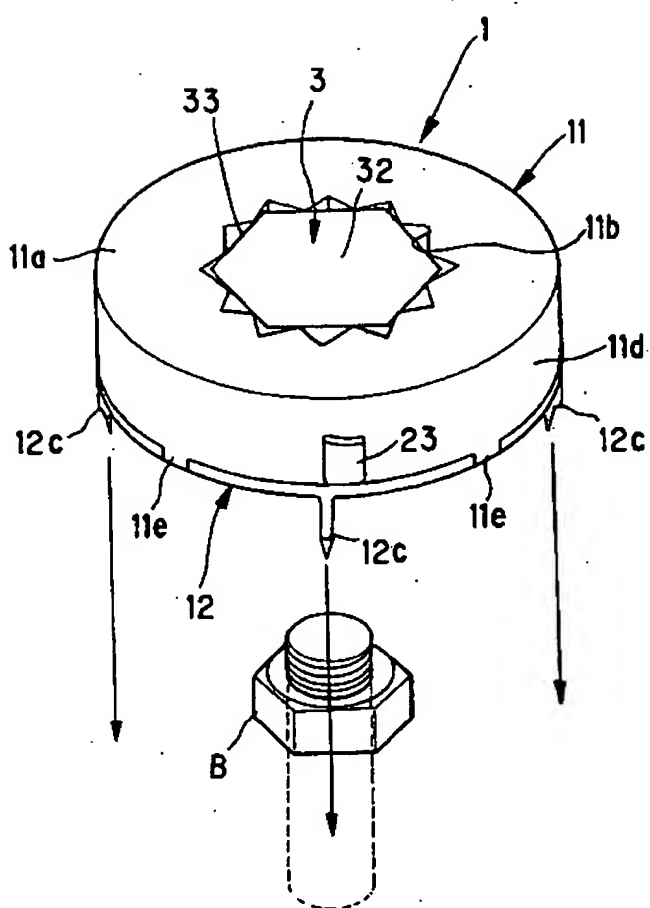




Fig. 7



F i g . 8



F i g . 9

